

SCIENCE

NEW YORK, OCTOBER 7, 1892.

IS THE MAYA HIEROGLYPHIC WRITING PHONETIC?

BY PROFESSOR CYRUS THOMAS.

I HAD not expected to ask any more space of *Science* at present for the further discussion of this subject. Nevertheless, as the interpretation of the aboriginal codices and inscriptions is now the most desirable thing relating to North American archæology, a few more pages may perhaps be profitably devoted to the subject, if confined to an earnest endeavor to arrive at the truth.

I have asserted that I find the Maya hieroglyphics to be in part phonetic, and that I have ascertained the interpretation of a sufficient number to form a key to the solution of the problem. This statement I firmly believe I can maintain, and trust I will be able to do so in the paper I am preparing for publication by the Bureau of Ethnology. In the meantime I have the kind permission of the Director, Major Powell, to present through the public press such samples as may be deemed sufficient to afford those working in the same field an opportunity of judging of the correctness of my claim. As Dr. Seler has (in *Science*, Aug. 26) seen fit to question this claim, some additional evidence is presented in this paper. I regret to say, however, that his criticisms appear to have been offered without proper consideration and to be based to a large extent on assumptions backed by no proofs.

As the attempt to reply to mere assumptions would drift the controversy into statements of personal opinions, simple reference to some of these and to some of his mistakes will suffice.

He asserts that the second element of the symbol interpreted *Cutz* (his Fig. 19) is not given in my letter-list, when in truth it is number 24 of that list. Referring to my interpretation by 2-*Yackin*, of his Fig. 29, he says it "is obviously erroneous," as "there does not exist a numeral designation with crosses between the dots;" when a dot and two crosses with a month symbol form a date in the bottom line of plate 49 Dresden Codex,—1 Mac. His statement that the first glyph shown in my Fig. 2, p. 46, is the same as that in certain groups he mentions, and as his Figs. 31–33, is incorrect, as he has failed to include the prefix. The character in his 31 is the same as my figure, but his 32 and 33 are different, as here the prefix, which is materially different from the others, forms part of the symbol and gives a different word. If I am right in my interpretation of this prefix by *ha*, it is possible,—although the translation this gives to the combination is not found in any lexicon I have at hand,—that the signification is suggested by *hacab*, "a sword, weapon to wound with, whip,"—Henderson (MS. Lexicon in possession of the Bureau of Ethnology) adds "rod." This agrees very well with what we see in the hands of the figures below, and also with what seems to be the general tenor of the series.

Dr. Seler is correct in stating that the sign of aspiration (his Fig. 16) found in Brasseur's "Landa," is not in the original text; nevertheless, we have to thank the Abbé for a happy suggestion. But his assertion that it is a substitute for the character shown in his Fig. 17 cannot be accepted, as both (16 and 17b) are found connected with the same glyph, as in Troano 17 and 16 and in Dresden 26 and 28. I may add that Dr. Seler has gone farther than Brasseur, as he has given us in his 17a a character which appears to be new,—at any rate I have been unable, by a careful search, to find it in any of the codices. It occurs in the general form given, but I have failed to find it with the two little interior dots and parallelogram. In a very few instances the parallelogram is present, but never the dots,—usually the only mark in the circle is a short curved line. These differences are minute

but important. As yet I have been unable to interpret this character, but think *u* is its chief element.

Speaking of the *e* symbol, he says "it occurs in various compound hieroglyphics" as those shown in his Figs. 26–28. His 26 (from Troano 31*) he says "refers to the rope trimmed with thorns (!) that the penitent used to draw through the pierced tongue." It would seem from this that he has taken the marks showing the twisted strands for thorns, as there is absolutely nothing else in the figure which could possibly suggest this idea. A moment's thought would have reminded him that, if the artist intended to show thorns, he would have projected them from the sides as in Charnay's figure to which he refers. The second part of his Fig. 26 is an *e*, the whole symbol (our Fig. 10) is probably correctly rendered by *Xel* (or *Xelem*), "to part, separate, cut, divide." The left member of the symbol has *x* as its chief phonetic element, but generally, as it seems, with *m* as a subordinate consonant sound. This interpretation agrees much better with the figures below the text than Dr. Seler's suggestion; and when we add that the character to the left of it (our Fig. 9) is to be interpreted *Zum* or *Zuum*, "rope, cord, line" (see the *m* in my letter-list), there is perfect agreement between the text so far as rendered and the figures, and the interpretations are all consistent with my letter-list. Referring to our Fig. 6, we have the two chief elements of these symbols combined in the word *Xamach*, "a vessel" which is found in more than one place accompanied by a vessel (see Codex Cortez 27).

It is by no means, as he claims, a "curious coincidence" that three words, expressing as many different actions, "should all contain an *e*." In fact, each of the three English words Dr. Seler uses to express the actions referred to—"pierce," "weave," "embroider"—contains two *e*'s. This objection on his part is therefore frivolous.

When he points out with perfect assurance "the prey-gods of the five regions," the "hunting god," "the dog of heaven that carries the lightning," and marks as stones what one at a single glance ought to recognize as the ends of cross-beams, or "weight-poles" with the wood symbol *Che* on them, it seems (and I say it with due regard to courtesy) unprofitable to attempt to follow him. To assume that his Fig. 29 is a variant of 30 is certainly straining a point to the utmost tension. Nor is he correct in stating that 30 is the glyph I interpreted in a former communication, "moisture"—that character was from the Cortesian Codex, p. 32. True, the parts are similar, but the details and surroundings are different. *Y'b*, as we have not learned the determinatives which indicate the vowel sounds, may be *Yeeb* "moisture" (Cortez 32); *Yib* "to liquefy or melt" (as honey, Troano 3*); *Yib* (or *Yb*), "a bean" or "beans" (his Fig. :0 and Dresden 18 and 19); we must therefore decide by the accompanying figures and details. A more thorough study and comparison of the characters will perhaps enable us ultimately to find the determinatives. The little crosses over 29 and 30 may have been placed there as helps in this respect; of this, however, I am unable to speak with any confidence, nor do I feel entirely satisfied with the rendering *Yax-kin*, although the parts are *Y'* and *kin*, and Dr. Seler's objection is not tenable.

He speaks of the fourth character of my Fig. 4 as being the same as a number of other characters he refers to, particularly the series on Troano 35* and Cortesianus 22. And he says "it is scarcely probable that in all these cases the reading *Xaan* should correspond to the matter expressed." It is apparent from this that he has overlooked a minute but important particular in that interpreted by me, which occurs but very few times in the codices. The little item at the front of the face, which is a very essential portion of the glyph, has not been carefully examined by him or he would not have fallen into the error of considering

those mentioned as the same. He had but to look to Fig. 3, same article, to see a difference, but he seems to have criticised the article without having thoroughly read it. There are a number of variations in this little character, whereby different words, as *Xaan*, *Xan*, *Xocan*, *Xolein*, *Xolan*, etc., are indicated. See, for example, Troano 4^c, 5^c, 7^b, 30^c, 31^c, 33^b, 32^c, 14^c; Dresden 4^b; all of which differ from one another. I must confess that his eyes are sharper than mine if he can find any figures in either of the codices representing a god or any one else beating a drum. This, like other of his assertions in regard to the significance of other figures, appears to be "merely hypothetical."

His assertion that Landa's first *a* is the head of the turtle, I think correct, as I long ago suggested (6th Rep. Bur. Eth., p. 348). I think he is also correct in assuming, as I had previously done, that his Fig. 6 indicates the Quetzal, and his Fig. 8 the *Moo* or large parrot (same report, pp. 355 and 356).

Dr. Seler, in closing his criticisms, expresses the opinion that "it would be far more appropriate to point out the real meaning as to the matter expressed, of each glyph." How are we to determine this real meaning? And by what evidence are we to verify our conclusions? His efforts in this direction appear to be far from satisfactory and lack that proof which brings conviction—in fact, in most cases are "merely hypothetical."

That the writing is largely phonetic can, I think, be proved without the interpretation of a single character. First, we have the statement of the early Spanish writers to this effect, Landa backing his assertion by an attempt to give the letter elements, and by a full series of the day and month symbols, which are verified by the codices. It is not likely that he was wholly in error in regard to the main fact where so many of the details have been verified. It appears from a statement by Father Alonso Ponce, quoted by Dr. Brinton,¹ that these characters were actually used by missionaries to impart instruction to the natives. In fact, the author quoted says "some of our priests understood and knew how to read them and also to write them." The internal evidence appears to confirm this view. The evident use of the same prefixes and suffixes to different characters leads to this conclusion. The fact that supposed deity symbols are very frequently followed by particular characters which may be supposed to indicate certain attributes is another evidence on this point. Other indications of phoneticism are found in the various combinations of the different elements; the use in some places of a seemingly conventional symbol to indicate an object (for example, the head of a figured bird) while in other places a character bearing no resemblance to the object is used; the fact that the terminal elements of the symbols for east and west are alike, and the final syllables of the words are the same, and also that a like repetition of elements is found in some of the month and day symbols where the sound is repeated,—*Cib*, *Caban*; *Pax*, *Chichan*; *Yaxkin*, *Yax*. Phoneticism appears, also, to be indicated by the fact that different characters are used to indicate certain months. Finally, the general character of the writing seems to forbid the idea that it consists of merely conventional symbols or that it can be explained on any theory short of a degree of phoneticism.

Assuming that it is phonetic, we are justified in making attempts at interpretation, but these to be successful should, I think, be based largely on certain considerations which will aid in obtaining correct solutions. Of course, the chief reliance is on the fact that the parts give appropriate results in new combinations, but the considerations I mention will furnish some aid in the work.

First, it is apparent to all careful students of these codices that they are formed upon a conventional plan. This is found to be, in general, as follows: What may be called a series or chapter is preceded by one or more columns of day symbols, over which are the numerals to be attached to them. From these, running along to the right, immediately below the text, is a series of black and red numerals, indicating certain days, as explained in my "Aids to the Study of the Maya Codices" (6th Ann. Rep. Bur. Eth., pp. 275-283). It is apparent from this order, the subdivisions of the plates, the arrangement of the pictures below the text, and

the method of grouping the written characters (see "Study MS. Tro.," pp. 137-138) that the subject of the text (usually arranged in groups of four or six compound characters over a pair of numerals, one red and one black) refers in some way to the day or period represented by these numerals. Second, very many of the pictures show masked individuals who represent certain deities or characters. Even where these pictures refer to the manners, customs, and industries of the people, the mask is usually worn by the male. As the forms of these masks are comparatively limited in number, we soon learn, by the repetition of certain characters in connection therewith, the symbols which denote these personages (or deities, if such they be). Third, there is often a certain parallelism in the groups of a series, which will, in some cases, enable us to determine the general subject of a series where but one or two characters can be deciphered. It will also, in some cases, enable us to decide with every assurance of being correct what certain characters of the series specifically refer to. This, as every one can see, is a great help in the attempts to decipher the text. Fourth, the general subject of certain series may

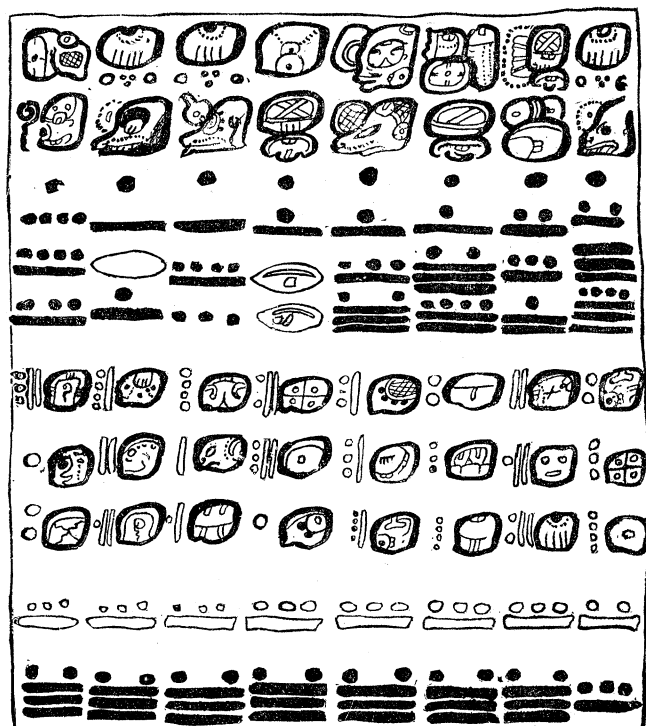


FIG. 1.

be inferred from the pictures; nevertheless, great caution is necessary in using this aid, as the Indian method of representing by figures ideas and actions was far different from that which would be adopted at the present day. The interpretation of a single character of a series will sometimes cast to the winds the conclusion we had reached in regard to the subject referred to. Fifth, the postures and clothing of the human figures represented and other details make it evident that the people were Indians in the full acceptance of that term; a fact which should lead us to the conclusion that the purport of the text is of that grade of thought and expression characteristic of the Indian culture-status. Sixth, the natural history and physical conditions and characteristics of the peninsula of Yucatan must be borne in mind; and, lastly, the historical evidence must be referred to, especially Landa's "Relacion."

To illustrate the aid afforded by the first of the foregoing items, and at the same time give interpretations of some characters reference is made to Fig. 1, which is the lower half of Pl. 55 of the Dresden Codex.² For the benefit of readers not familiar with the codices, we may state that the two upper transverse lines are glyphs forming the text; the four lines next below, of black dots

¹ *Maya Chronicles*, p. 63.

² A copy of the full plate is given on page 310 of the 6th Am. Rep. Bur. Eth.

and short lines, are numerals; the next three lines are day characters with accompanying red numerals; and the two lower lines are numerals (the outline or hollow numerals are red in the original). Taking the series by columns, we observe that each pair of glyphs, reading downwards, has its own series of numerals and day symbols. Hence we conclude that each pair forms a sentence, and that here the reading is downward or by columns.

Taking the left-hand column, we interpret it as follows, beginning with the character at the top: *Kilchalac*, "Malignant ulcer, sore, or wound." The next character below, *Bancimil*, "Pest, mortality, fatal epidemic." Before proceeding, it is necessary to remark that the first character as given in the figure is slightly erroneous. The little circle over the hatched portion has, in the original, the little parallelogram and two dots characteristic of the *l* (see *Science*, July 22, 1892, p. 44, Fig. 1, No. 13^c). Continuing downwards we have next one dot = 1, then four dots = 4, then a short line and four dots = 9, then a short line and three dots = 8. Next is 13Cib, then 1Caban, then 2Ezanah, three days with their accompanying numbers. Lastly, below these we have the red numeral, 8, and black numeral, 17, denoting 8 months and 17 days, the period which intervenes between two columns. It is only necessary to say here that the black numerals immediately below the text in this column denote 24 years, 9 months, and 8 days (see explanation in "Aids to the Study of the Maya Codices," 6th Ann. Rep. Bur. Eth.).

As this series, which runs through several plates, is divided, with few exceptions, into periods of 8 months and 17 days, it is reasonable to assume, if the text bears any relation thereto, that the portion of the text in a given column refers to something occurring in the period of 8 months and 17 days denoted by the lower numeral symbols. This gives us a clue to the signification of the two written characters at the top, which, taken in connection with what follows below, may be read "At this time occurred the deadly ulcer pest."

Very often, in addition to the general aids above mentioned, we find special aids relating to particular cases. This is true in this instance. We observe to the left of the face of the second character, a small corkscrew figure which, according to our interpretation, must have *b* as its chief phonetic element. If we look below in the same column at the symbols for *Cib* and *Caban*, we see the same corkscrew figure in each, and find *b* as a phonetic element of each.

Turning next to the third column from the left of our figure, we observe that the upper character is the second *M* symbol of our letter-list (*Science*, July 22) and that immediately below it are five dots. As *Ho* is the Maya word for "five," we may translate the whole symbol by *Homah*, "To submerge, overwhelm, beat down and destroy dwellings and other things, and to unroof houses." The second character is slightly incorrect in the figure, as it tacks a slender x-shaped figure in the right portion of the glyph; and the little figure in front of the eye of the animal-head should represent a rod passing through a little circle. This character we render by the Maya word *Chaac* or *Chac* because the head is like that of the Chac figure as shown in the Troano Codex. *Chaac* or *Chac* signifies "The tempest or tornado." Connected with the time symbols below, the interpretation will be, "At this time, or during this period, occurred a tempest which unroofed houses and destroyed dwellings." The little character in front of the eye of the second character is the lightning symbol,—the proof, however, of this must be omitted as it cannot be given without the introduction of several figures.

The two characters at the top of the seventh or next to the right-hand column, we translate as follows: *Bulzah*, "To inundate or be inundated." *Tamculul*, "Deep, profound." That is to say, "At this time the land was inundated to a great depth." The upper part of No. 2 is imperfect in our figure in not having a slight opening at the right end.

This hunting out of the lexicons Maya words to suit characters is of course mere childish play unless based upon a legitimate and scientific process.

First, from the second element in the symbols for the east and west cardinal points and of the month *Yaxkin* I obtain the hieroglyph for *Kin* or *Ki'*. This forms the first part of the character

I have translated above—*Kilchalac*—and gives us the *ki* or *kil*; the little circle above (corrected as suggested) is Landa's *l*; in the hatched portion of the right character I find the *ch* which is seen in the symbols for *chicchan* and *Pax*, in one as *ch* (soft) and in the other as *x* (sh). Thus we have *kil*, *ch'*, *l*. Of the next character translated we find the *b* in the corkscrew figure in front of the face,—as seen in *Cib* and *Caban*. The *cimil* symbol is seen in the face character. The signification of the *chaac* symbol is determinable independently of its phoneticism. It is found in Dres. 71^e, 72^e, and 73^e, where its relation to the tempest is evident. The *Ho* in *Homah* has not been verified, the dots may be, and I am inclined to believe are, used as a determinative or simply to indicate the aspirate; I can only assert positively that it is some word relating to the effect of the tempest, the principal phonetic element of which is *m*, and that the five dots below give better results as *h* than with any other phonetic element.

As the crucial test of attempts to decipher is that the characters shall give like results in new combinations, I present some specimens to show that my interpretations hold good in what seems to be a sufficient number of cases to justify or at least to furnish some basis for the claim made. The incompleteness of our lexicons and the probability that the language in which the codices are written is archaic must be borne in mind. It is, therefore, more than likely that very many cases will occur where, although we may know the chief phonetic element of each part of a compound character, we cannot interpret the whole. This will undoubtedly be true unless there are indications of the minor elements which have not as yet been discovered.

Let us take, for example, the *m* of my letter-list—shown here in Fig. 2. It is the same as the symbol of the day, *Ymix*, in which we find *m* a leading phonetic element. Fig. 3 (Dres. 50^e)¹ is the symbol for the month *Mac*. It is possible and even probable that this symbol, which here varies slightly from the conventional form, should be rendered *Camach* or *Camaach*, signifying "the jaws," as this appears to be the true name of the month. I was at first inclined to believe that Landa's character for this month was but a conventional symbol probably intended to represent the mouth, but am now convinced that it is phonetic.

I have asserted in a previous communication that Landa's symbol for *ma* is correct, but I should have said that it will be correct if the strokes indicating the *m* are inserted in the little circles at the ends. In our Fig. 5, taken from the lower end of the line in Dres. 69, we see possibly the original from which this author's symbol for the month *Mac* was taken, as it is used at this point to indicate the month. Here we see these strokes very distinctly, and in the ends of the lower character the little parallelograms indicating the *a*, hence we render the symbol by *Maach*, an abbreviation of *Camaach*, as given by Perez. Is there not in this fact a very strong indication, if not positive proof, of phoneticism?

The compound character shown in Fig. 4 is found in Tro. 9^{*b} and 10^{*c}. It occurs in the latter twice, the parts, however, reversed in the parallel groups (as unfortunately in our figure), while in that of 9^{*b} one part is placed above another. These variations do not necessarily indicate a difference in the phonetic value. Omitting the prefix *U*, this may be rendered *Makcab*, "To eat honey without chewing (that is, by sucking); to break into a bee-hive and steal the honey." As the parts *Cab* and *Mak* have the same signification when separate, the reversal of the parts of the symbol does not change the signification. By turning to the plates of the Tro. codex on which the symbols are found, the appropriateness of this rendering will be at once apparent. There we see the twisted red symbols denoting the fire, kindled beneath the bee-houses or hives, by which to smoke out the busy little workers. At least it is thus I interpret these figures.

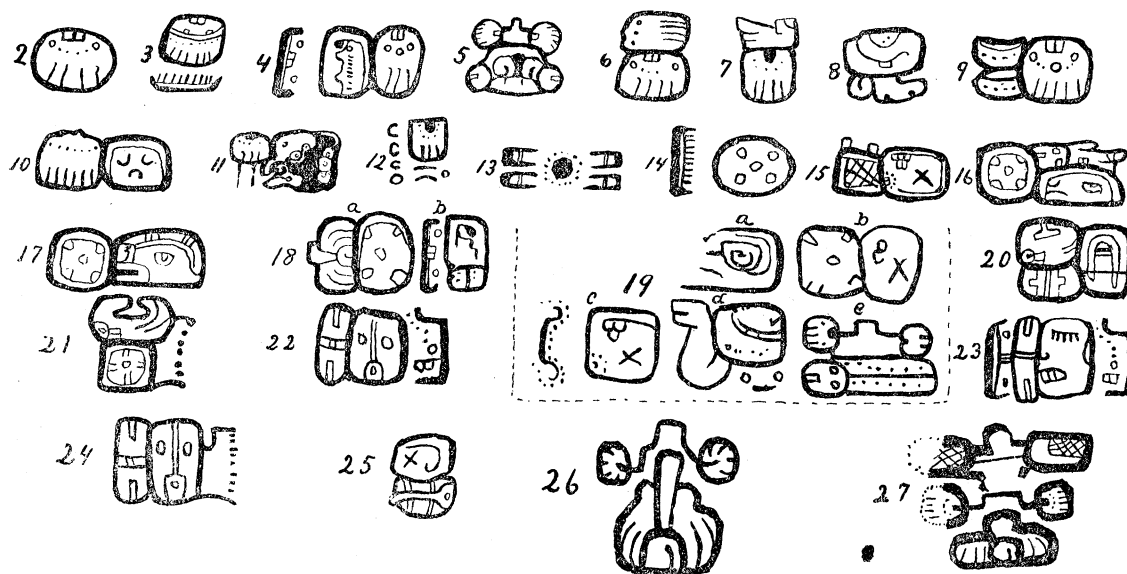
Fig. 6 (Cort. 27^a, Tro. 14^b and ^c, etc.): *Xamach*, "A vessel, a large earthen pot." It is also applied to the clay vessel in which tortillas were cooked. After the introduction of metallic vessels

¹ The abbreviations, Dres. for Dresden Codex, Tro. for Troano Codex, and Cort. for Cortesian Codex, are used in the remainder of the article. The letters, a, b, c, and d, following the pages indicate the transverse divisions beginning with a for the upper one.

by Europeans, it was applied to an iron plate used to bake bread upon (Henderson). In the codices it appears to have been used chiefly as the name of a jar and of vessels in which meat was cooked; see, for example, Cort. 27^a, where there are four symbols and four vessels, and a cardinal point symbol to each, probably indicating the relative positions in which they were to be placed. On Tro. 15^c we find the same symbol occurring in five parallel groups, four of them, with a cardinal point symbol accompanying each. The middle one may be interpreted with a strong probability of being correct; *xaman xamach*, *theeth* — ? —; "In the vessel toward the north the haunch or quarters — ? —." The fourth character, indicated by the interrogation point, I am unable to interpret.

Fig. 7. Tro. 17^c. *Chim* (*Chimil*), "A bag, sack, a kind of net." The object referred to is seen in the figure below the text, where it forms the net-like covering of the image-head in the vessel. The symbol in the same group — our Fig. 8 — which is a derivative of *Kal*, "to imprison, inclose, shut in," also corresponds with what is seen in the figure.

Fig. 9. Tro. 31^b. *Zum* or *Zum*, "rope, cord, line," and Fig. 10, same group, *Xel* or *Xelem*, "to part, separate, cut, divide," have been referred to above.



Figs. 2-27.

Fig. 11. Dres. 14^b and ^c and 46^b. *Maax*, "monkey, ape, imitator." The two dotted lines which fall in this symbol from the *m* character, I take to be indications of the double *a* and not of the *x*. The face, I think, is a mere conventional symbol. The personage with which this symbol appears to be connected is distinct from the dark figure which I have in a former publication assumed to be *Ekchuah*, the god of merchants, which is accepted by Rosny and Dr. Schellhas.¹

Fig. 12. Cort. 11^b. *Hahaymuc*, "To bury or inter superficially;" also "A stab or thrust given obliquely." The first definition applies very well to the act of planting corn shown in the figure below. The second agrees equally well with the idea of dibbling holes into the ground with the curved stick which the planter holds in his hand. Attention is also called to the fact that the sign of aspiration is duplicated in the symbol and the *h* is repeated in the word. The parallel passage in Tro. 31^b (left group) appears to have the signification of the second of the above renderings, though different symbols. We may remark in passing that this parallelism in passages and many other things show that the Cortesianus is not a part of the Troano, but a distinct codex, notwithstanding the divided "title-page."

Fig. 13. Cort. 20^b. *Hamah*, "To make a breach in a rampart; to break down or break open;" or *Hemeh* (from *Hem*), "To

lay a beam across a place, to traverse." Reference to the plate indicated will make apparent the appropriateness of this interpretation. In this symbol the *m* character is abbreviated to the upper or dot-surrounded portion alone.

As our Fig. 8 without the suffix is the well-known symbol for 20, which in Maya is *Kal*, we have two places in which the phonetic equivalent applies. The signification "to imprison or shut in" is also appropriate in Fig. 4 of my communication in *Science*, July 22, which gives us a third combination.

Now let us take the *b* character as given in my letter-list. It is given by Landa as his second *b* substantially as found in the codices; also in his symbols for the months Pop and Kayab as repeated in Dres. 46^c and 48^c. The following examples of its use in the codices are given with interpretations which I believe to be substantially correct. As those who are interested in the subject can make the comparisons and judge of the appropriateness of the renderings without explanations, I will make my comments brief.

Fig. 14. Tro. 12^b. Omitting the prefix *Ca*, I interpret *Bon* (*Bonah*), "to paint, dye, tinge, stain." Using the *Ca*, which has numerous significations, and the character which follows, shown in our Fig. 15, which we render *Xelche*, "groove or crack in the

wood," we obtain the following: "Paint twice the grooves in the wood," or "the two grooves."

Fig. 16. Tro. 31^d: *Bulahaan* or some derivative of *Bul*, *Bulah*, "To submerge, overwhelm with water." The character found immediately below, shown in Fig. 17, may be rendered by *Ban* (*Banah*), "To demolish, throw down, level with the ground." As the long-nosed god (Tlaloc?) is seen below overturning a jar of water on the sprouting corn, the appropriateness of the rendering is apparent.

Fig. 18 (a and b). Tro. 3^b. These two characters we translate *Yib-u-cab*, "To liquefy, melt, dissolve the honey."

Fig. 19 (a-e). Tro. 35^c. The characters *a*, *b*, *c*, *d*, *e*, which form one group, may be rendered with a probability of being correct, — following the order of the letters, — *Kuch bikyah hak* — ? — *ma-laah*, "The vulture moves from one side to the other with a tremulous motion in a wonderful manner — ? — without repeated buffetings." The first character of the group is not included, as it is well nigh obliterated; *a* is a conventional symbol, and I am unable to suggest the interpretation of *d*.

As our paper is necessarily limited, the above must suffice at present as examples of tracing the combinations of a single character. That those mentioned appear in numerous compound symbols which we are, as yet, unable to decipher, will be admitted; but this was to be expected, and must continue to be true until more complete lexicons of the language are obtained, or until some

¹ Brasseur, under *Akab-Max*, speaks of a phantom or hobgoblin of this name which he says signifies the "Great Monkey of the night."

one as familiar with it as with his native tongue takes hold of the work.

We will now call attention to some characters, the interpretation of which seems to give us a proper clue to the signification of the subjoined figures, sometimes very different, however, from the conclusion likely to be reached from a study of the figures (pictures) alone.

Let us take the leading symbol in the "baptismal" scene shown in Tro. 20^c. There are in this series four groups, each assigned to one of the cardinal points; this symbol, which is our fig 20, is found in each, hence must indicate some act, thought, or thing applicable to each of the figures below, which represent women apparently sprinkling children. We observe that the upper character of the symbol is the same as that of our Fig. 21, the symbol for *Chikin*, "west;" that the one below it is Landa's *H*, and that to the right his *i*. Putting these together we have *Chic-ha* (or *Chich-atah*)—*i*, or *ich*; "To rinse, cleanse, or wash with water, the child," or "the face."¹ A very simple and ordinary operation, but, like everything else which the priests could bring under control, was to be attended with certain religious or superstitious observances. Possibly this may refer to something of a more public character than the cleansing of children in the household.

In the middle divisions of Plates 24 and 25 Cortesianus, we see what we take to be a series of enclosed graves or sepulchres, the inclosure or vault being of wood fastened by thongs or withes. The dead are seen within, but on top of each a person stooping or lying down. What does this signify? Judging from the figures alone, several different and apparently equally applicable answers might be given. Referring to the text above (Plate 25), we observe the characters shown in our Figs. 22 and 23. The first (Fig. 22) we translate by *Paa-laahal* from *Pablaahal*, "To rip open, unseam; to cut, break or burst open." The second (Fig. 23) by *U-Paa Cimilhi*, "the enclosures of the dead." The article borne by the middle figure, Plate 25, appears to be the same as those in the hands of the individuals Tro. 23^c, where they appear to be used in severing the trunks of trees. Although odd-shaped implements to be used for this purpose, I have supposed them to be what may be termed saws, fitted with flint teeth. At any rate, they are used in some way in working in wood. Fig. 24, from same series, is probably a derivative of *Paaxal*, "To demolish, etc."

In Dres. 1^c the figure shows two individuals drawing a seine in which is a single fish, over which is the character shown in our Fig. 25, here turned on its side as in the original. This contains the same elements as No. 3, Fig. 2, *Science*, July 22, translated *Cutz*, "the turkey," but here they are reversed. Turning to Perez's lexicon, we find that *Tzac* is a little fish so named; Brasseur says a little fish resembling a sardine which inhabits the senotes.

As the symbol for *Xaman*, "north," Fig. 26 contains the characters for *ma* and *y* according to my theory, and lacks the *x* symbol, the question arises, How is this to be explained? That some of the day and month symbols, if phonetic, are abbreviated will become evident to anyone who will carefully study them. That the symbol for *Nohol*, "South," if phonetic, is also abbreviated must be admitted. The same is true of that for "north." Turning to Tro. 30^b, we find the symbol shown in our Fig. 27, which is here used for North. In each wing of the upper character we see the hatching indicating *x'x*; the middle one *ma*, and in the lower one the *y'*. Supplying the subordinate elements we have *xax-ma-yaam*, "the side without an opening" or "door." As *Nohol* signifies "the great door," this contrast is consistent and gives us a Maya name for north, and does away with the necessity, as Charencey supposes, of resorting to a foreign language for the word.²

NOTES AND NEWS.

At last there seems to be an awakening among Americans as to the food they eat, if we may judge from the interest taken in the food exhibitions which have been held of late years. A most

attractive exhibition of this kind has been opened at the Madison Square Garden in this city, and has combined with it a series of lectures, by Miss Parloa, on cooking. The exhibition ranges from a dairy—cows and all—to the toothsome buckwheat cakes. One thing brought out clearly is the simplification of housekeeping brought about by the use of the partially prepared viands now in the market. But we would suggest that substitutes, occasionally shown, can never take the place of the real articles.

—A European correspondent informs us that a Russian expedition is now in north-east Siberia for the purpose of bringing back a mammoth which has been discovered there frozen in a perfect condition. The writer adds that he has strong hopes the naturalist in charge of the expedition may discover the eggs of Ross's Rosy Gull (*Rhodostethia rosea*), as yet unknown to oölogists.

—The Bausch & Lomb Optical Co., Rochester, N. Y., recently issued the thirteenth edition of their "Illustrated Catalogue of Microscopes, Objectives, and Accessories." This firm has now made and sold ten thousand microscopes, not including thousands of dissecting microscopes, which means that their instruments are in very wide use in this country, and the firm takes pleasure in stating that a European demand is now growing, showing an appreciation of their work abroad. By contract with the well-known maker, Carl Zeiss of Jena, the Bausch & Lomb Optical Company are made the sole manufacturers, under the patents, of the Zeiss photographic lenses.

—The School of Political Science of the Brooklyn Institute of Arts and Sciences, for which provision has been made by the Department of Political Science of the Institute, and some account of which was published in *Science* for May 20, will be formally opened with a public meeting at Association Hall, on Monday evening Oct. 10. Mr. John A. Taylor, president of the department, and other well-known citizens of Brooklyn, who are interested in the movement, will address the meeting. At the same time the courses of study established by the committee on the school will be announced and described. The committee on the School of Political Science comprises some of the most successful business men in the city, as well as distinguished representatives of the professions and of the prominent educational institutions of Brooklyn, between which and the institute a cordial understanding and co-operation exist. The committee have taken great care in the selection of instructors for the school and the arrangement of the courses of study, and are well satisfied with the results thus far attained. The faculty of the school, so far as selected, consists of Charles H. J. Douglas, Professor of Political Economy, and Lewis G. Janes, Professor of Civil Government. Dr. Janes is well and favorably known in Brooklyn as the president for several years past of that very successful organization, the Brooklyn Ethical Association. He brings to his work in the school maturity, enthusiasm, and thorough scholarship, and will make his courses in civil government both popular and instructive. Professor Douglas, who has been secretary of the Department of Political Science since the resignation of Professor Frank J. Goodnow of Columbia College from that position two years ago, will have charge of the classes in political economy. He is a graduate of Brown University, and has studied at Yale, Johns Hopkins, Michigan, and Columbia, receiving from the last-named institution the degree of Doctor of Philosophy, and an appointment as Seligman Fellow in political science. It is expected that Dr. Douglas's work at the institute will be as successful and popular as it has been at the Brooklyn Boys' High School, in which for several years he has had charge of the work in political science. The matter of raising a permanent fund for the School of Political Science is one that should appeal strongly to those possessed of means and interested in the education of our youth in the duties of citizenship. A guaranty fund has been raised, sufficient to insure the support of the school irrespective of the size of classes for the first year; but a permanent endowment of \$50,000 or \$100,000 is needed to put the school in the best possible condition to do the work proposed by its projectors.

¹ Perez limits the signification of this word chiefly to rinsing the mouth, but Brasseur gives it a more general meaning.

² Actes. Soc. Philol., Tom. 20, p. 187.

SCIENCE:

PUBLISHED BY N. D. C. HODGES, 874 BROADWAY, NEW YORK.

SUBSCRIPTIONS.—United States and Canada.....\$3.50 a year.
Great Britain and Europe..... 4.50 a year.

To any contributor, on request in advance, one hundred copies of the issue containing his article will be sent without charge. More copies will be supplied at about cost, also if ordered in advance. Reprints are not supplied, as for obvious reasons we desire to circulate as many copies of *Science* as possible. Authors are, however, at perfect liberty to have their articles reprinted elsewhere. For illustrations, drawings in black and white suitable for photo-engraving should be supplied by the contributor. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

ANTARCTIC EXPLORATION.

BY HUGH ROBERT MILL, LIBRARIAN, ROYAL GEOGRAPHICAL SOCIETY.

CONSIDERABLE interest has been awakened by the greater part of the Dundee whaling fleet abandoning the Davis Strait "fishing" and taking their departure for the Antarctic seas. The venture is a purely commercial one, and has been in contemplation for some time, as the northern whaling has in recent years become almost unremunerative. Shortly before the vessels sailed it became known that they might possibly afford some facilities for scientific work, and the Royal Geographical Society (London), the Meteorological Office, and other institutions took steps to obtain successful observations. Additional chronometers and standard compasses were supplied to all the vessels, together with a complete set of the best meteorological instruments. The captains undertook to lay down their track as accurately as possible, and to fix the position and report upon the appearance of any land they might sight in the far south; also to observe the variation of the magnetic needle as frequently and carefully as they could. It is not likely that startling geographical discoveries will be made, although perhaps the coast of Graham's Land may be followed farther south and more accurately mapped. Everything in this department must depend on the discretion of the captains and the caprice of the whales. The vessels will not try to make a high latitude unless it is necessary to do so in order to get a cargo, but the captains will not hesitate to force their way far into the ice if they find it to be necessary, and from their long Arctic experience in ice-navigation it is safe to say that nothing less than an impenetrable barrier will stop them.

It is unnecessary to remind the readers of *Science* that since the expeditions of Wilkes and Ross, fifty years ago, no explorations worthy the name have been made in Antarctic seas. The *Challenger*, probably the only steamer that has gone so far south, merely crossed the Antarctic circle, and, being unprotected against ice, had immediately to return. Recent oceanographical and meteorological researches have gradually increased the desirability of improved knowledge of high southern latitudes, and representations have been made on several occasions as to the advisability of a properly equipped scientific expedition being sent out by the British Government. While this desirable expedition is deferred, the necessarily fragmentary results of trading voyages may afford most valuable hints,

The four Dundee ships, which sailed on September 6, 7, and 8, are barque-rigged wooden vessels fully protected for ice-work and provided with auxiliary steam. Their tonnage is about 400, but on account of the enormous thickness of their timbers the size externally is nearly that of 600-ton ships. Three of the vessels, the "Balaena," Captain Fairweather; the "Active," Captain

Robertson; and the "Diana," Captain Davidson, carry surgeons who were specially selected on account of their scientific tastes and their willingness to utilize all opportunities to the full. Mr. W. S. Bruce, the surgeon of the "Balaena" has a very complete equipment of apparatus for sea-temperature work and for biological collecting. He is accompanied by an Edinburgh artist, Mr. W. G. Burn Murdoch, who goes specially with the object of sketching the scenery of the southern ice. Dr. Donald on the "Active," and Mr. Campbell on the "Diana" are also equipped with appliances for collecting. Each of the ships carries a photographic apparatus.

The scientific results expected on the return of the whalers six or seven months hence are as follows: Full meteorological logs with records of surface sea temperatures and densities, and of temperatures at a few points down to the depth of 150 fathoms; deeper observations would be impracticable without hampering the real business of the cruise. A large collection of small surface organisms will be secured by tow-nets, a mode of collecting for which there will be unlimited opportunities as the vessels slowly follow their boats when engaged in whaling. No dredging can be attempted in deep water, but it is possible that there may be some shore-collecting in southern lands not previously visited. Observations on ocean-currents will be made by the captains in the ordinary course of navigation, but floats will also be launched in high southern latitudes, the recovery of which will be looked for with interest. Special attention will be directed to all phenomena connected with sea-ice, and, in case of any mud or stones being observed embedded in icebergs, an effort will be made to secure specimens in order to get some idea of the geology of the land hidden under the southern ice-cap. A large and representative selection of birds will almost certainly be secured, and some problems as to migration may be elucidated. Samples of sea-water from various depths will be brought back for careful analysis.

From a scientific point of view the expedition will be the more successful the worse it is commercially; for, if whales are not found on the margin of the ice, a very high latitude may be reached during the search for them. In any case the barometric readings are bound to be of the greatest interest, as they will throw light on the remarkable area of permanent low pressure which surrounds the South Pole. And it is impossible that the observations of so many highly trained sailors and enthusiastic naturalists can be barren of results in many departments.

THE ABORIGINAL USE OF BONE IN VERMONT.

BY G. H. PERKINS, UNIVERSITY OF VERMONT.

OBJECTS wrought from bone appear to be quite uncommon throughout the country, unless it be in the neighborhood of shell-heaps. Certainly in the Champlain Valley they are the rarest of archaeological finds, and until within a few years none had been found, so far as is known to the writer. At Plattsburgh, on the New York side of the lake, a few pointed implements and barbed spear-points have been found, and are in the fine local collection made by Dr. D. S. Kellogg of that place; but until very recently none had been found on the Vermont side, and they are still exceedingly rare, although, in all, many hundreds of stone implements and ornaments, some of them of very fine workmanship, have been discovered, as well as many fragments of decorated earthenware and a few implements of copper and ornaments of shell.

For many purposes, as awls and the like, bone would seem better suited than stone and much more easily worked; and it is hardly conceivable that bone was not used more commonly than is indicated by our collections. And yet, making all possible allowance for the perishability of bone, we cannot suppose that objects made of this material were ever very abundant; for the other specimens found in some of our localities are not very ancient; and, in more than one instance, entire bones have been found in fair preservation, and there is no reason to think that if bone objects had ever been associated with those of stone they would not now be found with them.

We must then conclude that, for reasons sufficient to themselves, the former occupants of the Champlain Valley did not fashion many of their implements or ornaments from the bones of the animals which they captured, although we must admit that the few specimens found do not fairly represent the entire stock of such objects which were made and used.

After collecting in this region for more than fifteen years without seeing a single specimen of worked bone, the first one made its appearance near an old village-site, while I was digging out some bits of pottery from beneath a pine stump. It was only a tine of a deer's antler, the surface of which had been smoothed, and a rudely cut groove was about the large end, as if to enable the owner to fasten a cord for suspending the object as an



FIG. 1.

ornament. So little-wrought a specimen would attract little attention usually, but it was taken associated with stone implements, from beneath a pine stump, and was our first of its kind, and therefore possessed especial value. It is white and somewhat chalky in appearance; but I do not suppose it to be necessarily of great age, though not very recent. This specimen is about four inches long and three-fourths of an inch in diameter at the larger end. A second and shorter tine was recently found in another locality. The point of this is smoothed, and it may have been used in the decoration of the pottery which was so commonly used, and which was most frequently ornamented with lines, grooves, and the like, made by a more or less blunt point drawn across the unbaked surface of the jars. The most perfectly made and finished point found in Vermont is shown full-size in Fig. 1. It is made from a fragment of a tibia, or some other round bone, and nearly the whole surface,



FIG. 2.

except the groove of the medullary canal, is well smoothed, and the pointed end is exceedingly well finished. This specimen was found not far from Burlington, and with it were fragments of bones, a canine of a bear, as well as stone implements. From the simple unornamented objects, such as those just mentioned, to such as that shown in Fig. 2, is a long step, but we have nothing intermediate. The specimen shown in Fig. 2 is, as the figure shows, broken along the upper and lower edge. Whether it originally was made from an entire section of a round bone, or was merely a fragment as we have it, is not readily determined. If fractured since it was ornamented, the breaking is not recent. It may have been a whistle, or tube for some other use.

As to the decoration, a glance at the figure will give a better idea of that than any description. The lines are sharply incised and quite regular, although the tool by which they were made

now and then went a little astray, and the whole effect is very neat. The ends are smooth and somewhat bevelled or rounded. The length of this specimen is a little less than three and a half inches, and the greatest width three-fourths of an inch. It was found near Swanton, not far from the Canada border.

Another, and, if genuine Indian work, very interesting specimen is a mask made from a piece of a femur or some thick bone. The face is boldly and not unskilfully carved, the features all of them being strongly marked. It was found buried in the earth, not far from the specimen figured above, near Canada, and may quite possibly be the work of a passing hunter or soldier; and it is also, and perhaps equally, possible that it was carved by one of the St. Francis Indians, who formerly roamed about the region where it was found. It is apparently not very ancient. The face is oval, an inch and three-eighths long, and one and one-eighth wide, and, including the rather prominent nose, five-eighths of an inch thick.

The list here given is certainly very meagre, but it includes all kinds that have been found, and its brevity simply emphasizes the rarity of such objects in Vermont.

ON THE INTROSPECTIVE STUDY OF FEELING.

BY HIRAM M. STANLEY, LAKE FOREST UNIVERSITY, ILL.

OF all the sciences psychology is, perhaps, the most imperfect. If a science is a body of knowledge obtained by special research and accepted by the general *consensus* of specialists, then psychology is so defective as to scarcely merit the name of science. This want of *consensus* is everywhere apparent and must especially impress any one who compares the lack of harmony in manuals of psychology with the practical unanimity in manuals of botany, geology, physics, and other sciences. Even in the most fundamental points there is no agreement, as will be evident in a most summary statement.

It is now something more than a century since the general division of psychic phenomena into intellect, feeling, and will, first came into repute, but still some psychologists of note do not agree to this fundamental classification, but would unite feeling and will in a single order. As to the subdivisions of feeling and will we are confessedly wholly at sea. In intellect it is only on the lower side, sensation and perception, that anything of great scientific value has been accomplished; and even now it cannot be said that the classes of sensation have been marked off with perfect certainty. In the higher range of intellect psychology can do scarcely more than accept some ready-made divisions from common observation and logic. And if so little has been settled in the comparatively simple work of a descriptive classification of the facts of mind we may be assured that still less has been accomplished toward a scientific *consensus* for the laws of mind. Weber's law alone seems to stand on any secure basis of experiment, but its range and meaning are still far from being determined. Even the laws of the association of ideas are still the subjects of endless controversy. Also in method there is manifestly the greatest disagreement. The physiological and introspective schools each magnify their own methods sometimes so far as to discredit all others. Physiological method has won for itself a certain standing, indeed, but just what are its limitations is still far from being settled.

But the grievous lack of generally accepted results is most apparent in the domain of feeling. The discussion of feeling in most manuals is very meagre and unsatisfactory. Professor James's recent treatise, for instance, gives some 900 pages to the Intellect, and about 100 pages each to Feeling and Will. There is little thorough analysis and no perfected inductive classification. We often, indeed, find essays of literary value which appeal to the authority of literature. But to refer to Shakespeare or Goethe as psychological authorities or in illustration or proof of psychological laws is generally a doubtful procedure. The literary and artistic treatment of human nature is quite distinct from the scientific, and literature and art cannot be said to be of much more value for psychology than for physics, chemistry, or biology. To appeal to the Bible or Shakespeare in matters psychological,

is usually as misleading as to consult them for light on geology or botany. Even the fuller treatises on the subject of feeling rarely reach beyond literary method and common observation, being for the most part a collection and arrangement of the results of common sense, accepting common definitions, terms, and classifications. Now, science is always more than common sense and common perception, it is uncommon sense; it is an insight and a prolonged special investigation which penetrates beneath the surface of things and shows them in those inner and deeper relations which are entirely hid from general observation. Common views in psychology are likely to be as untrustworthy as in physics or astronomy, or any other department. Science must, indeed, start with common sense but it does not deserve the name of science till it gets beyond it.

Again, the subject of pleasure, pain, and emotion, is usually discussed with considerable ethical or philosophical bias. The whole subject of feeling has been so naturally associated with ethics and philosophy from the earliest period of Greek thought that a purely colorless scientific treatment is quite difficult. Furthermore, feeling has been too often discussed from an *a priori* point of view, as in the rigid following out of the Herbertian theory of feeling as connected with hindrance or furtherance of representation. Still further, the physical side of emotion has been so emphasized by the physiological school as to distract attention from purely psychological investigation. How far this may lead is seen in Professor James's theory of emotion which makes it the reflex of the so-called expression.

It is obvious, then, on the most cursory review that very little has been accomplished in the pure psychology of feeling. Here is a region almost unexplored, and which, by reason of the elusiveness and obscurity of the phenomena has seemed to some quite unexplorable. Dr. Nahlowsky truly remarks, that feeling is a "strange mysterious world, and the entrance to it is dark as to Hades of old." Is there any way out of this darkness and confusion? If the study of feeling is to become scientific and give assured results, we must, I think, assume that all feeling is a biological function governed by the general laws of life and subject in origin and development to the law of struggle for existence. Assuming this strictly scientific point of view we have to point out some difficulties in the way of the introspective psychology of feeling as compared with other departments of biological science.

We trace directly and with comparative ease any physical organ and function from its simplest to its most complex form; for example, in the circulation of the blood there is clearly observable a connected series from the most elementary to the most specialized heart as developed through the principle of serviceability. In some cases, as in the orhippus, a form in the evolution of the horse, we are able to predict an intermediate organism. Psychology is still far from this deductive stage; we have no analogous series of psychic forms, much less are able to supply, *a priori*, the gaps in a series. The reason for this is mainly the inevitable automorphism of psychological method. In biology we are not driven to understand life solely through analogy with our own life, but in psychology mind in general must be interpreted through the self-observation of the human mind. In biology we see without effort facts and forms of life most diverse from our own; the most strange and primitive types are as readily discernible as the most familiar and advanced, the most simple as the most complex. We study a fish just as readily as a human body, but the fish's mind—if it has any—seems beyond our ken, at least is not susceptible of direct study, but a matter for doubtful inference and speculation. Whether a given action does or does not indicate consciousness, and what kind of consciousness, this is most difficult to determine. Thus we have the most various interpretations, some, as Clifford, even going so far as to make psychic phenomena universal in matter, others, on the other hand, as Descartes, limiting them to man alone.

The difficulty of this subjective method, this reflex investigation, is almost insurmountable. Consciousness must act as both revealer and revealed, must be a light which enlightens itself. A fact of consciousness to be known must not simply exist like a physical fact or object, as a piece of stone, but it must be such

that the observing consciousness realizes or re-enacts it. To know the fact we must have the fact, we must *be* what we *know*. Mind is pure activity, we do not see an organ and ask what it is for, what does it do; but we are immediately conscious of consciousness as activity, and not as an objective organ. We must here then reverse the general order and know the activity before we can identify the organ as a physical basis.

By the purely objective vision of the lower sciences we can easily determine a genetic series of forms most remote from our own life, but in psychology, mind can be for us only what mind is in us. The primitive types of psychosis are, no doubt, as remote and foreign from our own as is the primitive type of heart or nervous system from that of man's. In the case of heart and nerve we can objectively trace with certainty the successive steps, but in endeavoring to realize by subjective method the evolution of mind we are involved in great doubt and perplexity. How can we understand an insect's feelings? How can we appreciate minds which are without apprehension of object, though there is reason to believe such minds exist? Only to a very limited extent can a trained and sympathetic mind project itself back into some of its immediately antecedent stages. Consciousness, because of its self-directive and self-reflective power, is the most elastic of functions, yet it can never attain the power of realizing all its previous stages. Sometimes, however, the mind in perfect quiescence tends to relapse into primitive modes, which may afterward be noted by reflection, but such occasions are comparatively rare. The subjective method means a commonalty of experience which is often impossible to attain. Thus a man may believe there are feelings of maternity; he has observed the expression of nursing mothers, and knows in a general way that here is a peculiar psychosis into which he can never enter, and which is, therefore, beyond his scientific analysis. The psychic life of the child is more akin to his than that of the mother; yet it is only by an incessant cultivation of receptivity and repression of adult propensities that one can ever attain any true inkling of infant experience. There is then, I think, a vast range of psychic life which must forever lie wholly hidden from us either as infinitely below or infinitely above us; there is also an immense realm where we can only doubtfully infer the presence of some form of consciousness without being able to discriminate its quality, or in exceptional cases to know it very partially; and there is but a relatively small sphere where scientific results of any large value may be expected. By reason of its objective method the realm of physical science is practically illimitable, but psychic science is by reason of its subjective method kept forever within narrow boundaries.

We must then take into account the inherent difficulties of the subjective method as applied to the study of feeling and mind in general and yet we must recognize its necessity. No amount of objective physiological research can tell us anything about the real nature of a feeling, or can discover new feelings. Granting that neural processes are at the basis of all feelings as of all mental activities, we can infer nothing from the physiological activity as to the nature of the psychic process. It is only such feelings and elements as we have already discovered and analyzed by introspection that can be correlated with a physical process. Nor can we gain much light even if we suppose—which is granting a good deal in our present state of knowledge—that there exists a general analogy between nerve growth and activity, and mental operations. If relating, i. e., cognition, is established on basis of inter-relation in brain tissue, if every mental connecting means a connecting of brain fibres, we might, indeed, determine the number of thoughts but we could not tell what the thoughts were. So if mental disturbance always means bodily disturbance, we can still tell nothing more about the nature of each emotion than we knew before. We must first know fear, anger, etc., as experiences in consciousness before we can correlate them with corporeal acts.

Is now this necessarily subjective method peculiarly limited as to feeling? Can we know feeling directly as psychic act or only indirectly through accompaniments? Mr. James Ward (*vide* article on Psychology in the Encyclopædia Britannica, p. 49 cf. p. 71) remarks that feelings cannot be known as objects of direct

reflection, we can only know of them by their effects on the chain of presentation. The reason for this is that feeling is not presentation, and "what is not presented cannot be re-presented." "How can that which was not originally a cognition become such by being reproduced?"

It cannot. But do we need to identify the known with knowing, in order that it may be known? Must feeling be made into a cognition to be cognized? It is obvious enough that no feeling can be revived into a re-presentation of itself, but no more can any cognition or any mental activity. Revival or recurrence of consciousness can never constitute consciousness of consciousness which is an order apart. If cognition is only presentation and re-presentation of objects, we can never attain any apprehension of consciousness, any cognition of a cognition or of a feeling or of a volition, for they are all equally in this sense subjective acts. Re-presentation at any degree is never by itself sense of re-presentation or knowledge of the presentation.

Of course, the doctrine of relativity applies to introspection as to all cognition, and subject *qua* subject is as unknowable as object *qua* object. We do not know feeling in itself, nor anything else in itself, the subjective like the objective *ding an sich* beyond our ken. Yet kinds of consciousness are as directly apprehended and discriminated as kinds of things, but the knowing is, as such, distinct from the known even when knowing is known. Here the act knowing is not the act known and is different in value. The object known is not, at least from the purely psychological point of view, ever to be confounded with the knowing, to be incorporated into cognition by virtue of being cognized. Feeling, then, seems to be as directly known by introspection and reflection as any other process. It is not a hypothetical cause brought in by the intellect to explain certain mental phenomena, but it is as distinctly and directly apprehended as cognition or volition.

The distinction between having a feeling and knowing a feeling is a very real one, though common phraseology confuses them. We say of a brave man, he never knew fear; by which we mean he never feared, never experienced fear, and not that he was ignorant of fear. Again, in like manner, we say sometimes of a very healthy person, he never knew what pain was, meaning he never felt pain. These expressions convey a truth in that they emphasize that necessity of experience in the exercise of the subjective method upon which we have already commented, but still they obscure a distinction which must be apparent to scientific analysis. We cannot know feeling except through realization, yet the knowing is not the realization. Being aware of the pain and the feeling pain are distinct acts of consciousness. All feeling, pain and pleasure, is direct consciousness, but knowledge of it is reflex, is consciousness of consciousness. The cognition of the pain as an object, a fact of consciousness, is surely a distinct act from the pain in consciousness, from the fact itself. The pain disturbance is one thing and the introspective act by which it is cognized quite another.

These two acts are not always associated though they are commonly regarded as inseparable. It is a common postulate that if you have a pain you will know it, or notice it. If we feel pained we will always know it. This seemingly true statement comes of a confounding of terms. If I have a pain I must, indeed, be aware of it, know it, in the sense that it must be in consciousness; but this makes, aware of pain, and knowing pain, such very general phrases as to equal experience of pain or having pain. But there is no knowledge in pain itself, nor pain in the knowing act *per se*. The knowing the pain must be different from the pain itself, and is not always a necessary sequent. We may experience pain without cognizing it as such. When drowsy in bed I may feel pain of my foot being "asleep," but not know it as a mental fact. We may believe, indeed, that pain often rises and subsides in consciousness without our being cognizant of it, but, of course, in the nature of the case there is no direct proof, for proof implies cognizance of fact. Pain as mental fact, an object for consciousness, not an experience in consciousness, is what is properly meant by knowing pain. Consciousness-of-pain as knowledge of it is not always involved by pain-in-consciousness as experience of it. Consciousness of pain by its double meaning

as cognizance of pain and experience of pain leads easily to obscurity of thought upon this subject. But experience does not, if we may trust the general law of evolution from simple to complex, at the first contain consciousness of experience. This latter element is but gradually built up into experience, though in the end they are so permanently united in developed ego life that it is difficult to perceive their distinctness and independence.

We conclude then that while not all feelings, that is, pains and pleasures, are discovered simply by virtue of being acts of consciousness, and that not all consciousness is apperceptive of itself, yet in general feelings are known as such, and there is nothing in their nature to make them only indirectly observable by consciousness. The direct subjective method certainly presents great difficulties especially in evolutionary psychology, but still it must be accounted the only method for feeling as for all regions of psychic life.¹

REMARKS ON AMERICAN LICHENOLOGY. — II.

BY W. W. CALKINS.

IN the *Lichens* the geographical distribution of species is quite as interesting as in phænogamia. I shall in this paper confine myself to observations and collections made in the sub-tropical section of our country. The tracing of species to their native habitats, and thence following them over often wide areas of dispersion until arrested in their progress by conditions unsuitable to their growth, is an important work for the botanist and for science. Florida — more especially its southern extremity — offers an attractive field and unusual advantages. One may draw a line east and west across the State in about latitude 25°, and below this will be found new conditions of soil, climate, and productions. A new and peculiar flora exuberant in growth will come into view. With both shores laved by the warm waters of the Gulf Stream, that "river in the ocean," also the Bahamas and Cuba less than one hundred miles distant, the reasons for the similarity of life to that of the Antillean system are plain. One has only to wander along these sunny shores and gather by bushels the proofs of what I say in such species as *Guilandina*, *Bonduc*, *Mucuna*, *Urens*, etc., that have been brought by the sea from other climes.

Then tropical Algæ claim the attention. Approximately the line I have mentioned represents two vast and dissimilar floras, each overstepping somewhat the territory of the other, but retaining the mastery in their respective fields. Here northern forms become intruders, southern less common. Many arborescent ones dwindle to shrubs. *Per contra*, further north the same law obtains. Thus hath nature set her limits. Standing on this borderland, and amazed at the change in the higher orders, I wished to know about the lower. In this field not much has been done. Our knowledge of the lichens has been until recently limited. It is my purpose to extend this knowledge somewhat, believing that it may be useful.

Most of the species described by Nylander and Tuckerman, as from Cuba and some from further south, will be found in Florida. The great order *Graphidacei*, one of the most perplexing, abounds in new species, and I am satisfied that further research will add to the number in this and other orders. I now make nearly four hundred and fifty species, which is indeed a great number for one section when we remember that only a few years ago Willey estimated that ultimately one thousand might be found on the entire continent. The final total in Florida will exceed five hundred; and I allow for some reductions which must follow their final resolution, for, as hinted in a former paper, this is more important than new species, especially if, as asserted, "species only exist in text-books," — a proposition from which I dissent.

The following observations will only embrace a few of the rarer and little-known forms collected by me, and some others of my discovery described as new to science: *Gyalecta cubana* Nyl. On calciferous rocks, Keys of Florida, and on the main land. Also in Cuba. Identified by Dr. Nylander. *Chiodecton sphaerale* Nyl. A rare tropical form first found by me near Jacksonville — and

¹ For a special carrying out of the principles herein advocated see the writer's article on Primitive Consciousness in the *Philosophical Review*, July, 1892.

south — on *Nyssa aquatica*. *Trypethelium sprengelii* Nyl. On various barks of trees, Key West to Jacksonville. *Opegrapha diapharoides* Nyl. On oaks from Jacksonville south. The great genus *Biatora* has many species. Of these *B. carneo-albens* Nyl. and *B. floridensis* Nyl., found by me on *Carpinus*, are new, and of tropical derivation. Two other great genera, *Arthonia* and *Graphis*, teem with new species and rare forms. These find here their greatest expression, and the latter is reduced north of Florida to a very few species.

CURRENT NOTES ON ANTHROPOLOGY.—XVI.

[Edited by D. G. Brinton, M.D., LL.D.]

Linguistics as a Physical Science.

WHEN one surveys the works on linguistics which have appeared in the last few years, especially such as deal with the principles of changes in languages, it is easy to classify their writers into two groups, the one preferring to explain such changes by processes of mind, the other by purely physical conditions. This distinction goes back to that which would regard linguistics as a branch of natural history, and its laws no other than purely physical ones; or, on the other hand, that which claims the changes in language come chiefly through principles of psychology, logic, and metaphysics.

Some have aimed at a compromise by saying that linguistics is in its contents a mental science, but in its methods a natural science. Professor H. Schuchardt remarks, in a late number of the *Literaturblatt für Ger. und Roman. Philologie*, that it would be just as correct to reverse this statement, or to take the position that it is half a natural and half a historical science; provided that in the latter case we understand the two members of the proposition to be successive and not contradictory, the natural element passing into the historical. "Because," he concludes, with a remarkable expression of his position, "I believe in the unity of the science, and hold that there is no greater difference between biology and linguistics than between biology and chemistry."

Gerland's Atlas of Ethnography.

I have had at hand all summer the "Atlas der Völkerkunde," by Dr. Georg Gerland, professor at the University of Strasburg (1 Vol., Gotha, Justus Perthes, 1892), and can speak of it now after that much use. It is composed of fifteen folio maps, and, as it is, I believe, the first complete ethnographic atlas ever published, it will not be out of place to give its contents. They are: I., Distribution of skin and hair; II., Density of population; III., Distribution of religions; IV., Distribution of diseases; V., Clothing, food, dwelling, and occupations; VI., Location of peoples in 1500 and 1880; VII., Europe in 1880; VIII., Asia in 1880; IX., South-east Asia; X., Oceanica; XI., Africa; XII., Aboriginal America; XIII., America in 1880; XIV., Linguistic map; XV., Europe about 100–150 after Christ.

The first impression one has in examining the Atlas — and with me it is one that remains — is that entirely too much is attempted for a work of the size. The charts are necessarily on too small a scale and omit too much to be satisfactory for the special student; and what student is not special nowadays? The list of subjects above given will be enough to convince the reader that detail cannot be attempted in most of the charts. Turning to the map of the American aborigines, there is an evident lack of classification. For instance, what does "Peruvian peoples" mean? It is neither a linguistic nor physical group, and scarcely a political one. All tribes of Chili, Patagonia, the Pampas, and Tierra del Fuego are included under one rubric, and called "Chilians or Patagonians." Such classifications are worse than worthless, because they are misleading; and these by no means stand alone.

But it would be unfair to measure this atlas by its treatment of America, which, as usual in all works of the kind, suffers the most. In general, the Atlas is one of immense labor and of corresponding value. It ought to be in the library of every geographer and student of ethnography.

To Deduce the Stature from the Measurements of the Long Bones.

This is a problem which has occupied anatomists considerably, without leading to as uniform conclusions as one could wish. There are important ethnic variations in the length of the long bones of both extremities, as is well known, and others run in families, or are peculiar to the individual. Scott says of Rob Roy, that standing straight he could tie his garter below the knee. Such a statement makes an osteologist wish for his bones! Long fore-arms are ethnically a sign of an inferior race. Hence all proportions must to some extent be modified by considerations of race.

A general formula has lately been advanced by M. Etienne Rollet, which seems to me, after comparing it with the measurements in Topinard, Schmidt, and others, the most convenient I have seen, and sufficiently accurate. The list of coefficients is stated as follows in the *Revue Scientifique* for August:—

	Femur.	Tibia.	Fibula.	Humerus.	Radius.	Ulna.
Min.	3.66	4.53	4.58	5.06	6.86	6.41
Max.	3.71	4.61	4.66	5.22	7.16	6.66

It is enough to multiply the length of the long bone named by the coefficient given above, to obtain the height; and by taking the average of a number of such measurements we reach a figure accurate enough for the height of either sex. I say accurate enough, because there is no use in being excessively precise on this question. It is well known that there is quite a difference in our stature when we rise in the morning, and when we go to bed after a hard-day's walk.

The Birch-Tree as an Ethnic Landmark.

In a late number of the *Globus*, Dr. Krause of Kiel reviews the question of the origin of the Aryan nations as shown by the word for *birch*. The terms for birch and willow are the only two tree-names which are common, or practically so, to all tongues of the Indo-Germanic group. The ancestors of all must have come, therefore, from some locality where these trees were indigenous, and where they were of importance in the economics of the ancestral horde. The birch meant is the *Betula alba*, or white birch, and its uses in primitive conditions are numerous and familiar, as are also those of willow twigs.

All this is well known, and therefore not new. But the conclusion which has been drawn from it in favor of the derivation of the Indo-Germanic peoples from the habitat of the birch in the north of Europe is seen to be unsubstantiated, when we learn that the *Betula alba* flourishes all through Siberia, from the highlands of Afghanistan to Japan, and that two closely allied species, the *acuminata* and the *hjojpattra*, are found in various parts of the Himalayas, and in the mountains of central Asia. In Iran and on the plains of Turkestan none of these trees occurs. It would seem, therefore, that this single verbal identity does not carry us far.

To show how close the correspondences of the names of the tree are, I will quote some: English, *birch*; High German, *birke*; Hindustanee, *burj*; Sanscrit, *bhurja*; Italian, *bedoja*; Latin, *betula*; Irish, *beithe*, etc. It is a marvel to see how through unnumbered generations and over so many thousands of miles the word has retained its physiognomy.

Slavic Archæology.

Dr. Lubor Niederle is privat-docent in the branches of anthropology and pre-historic archæology at the University of Prague. That city is quite decidedly Check or Slavic, and much of the instruction is carried on in the Bohemian dialect of that tongue. In it, also, Dr. Niederle publishes his works, the last of which treats of pre-historic man in Europe with especial reference to the archæology of the Slavic countries. The title is "Lidstvo v Době Prědhistorické." It is to be hoped that of a portion of it he will prepare an abstract in French or German, as the Bohemian is a dialect with which most scientists are not familiar. The importance of such an abstract is the greater because many Slavic observers, especially local archæologists, have in late years taken

to publishing their articles exclusively in journals in their own tongue, and it thus becomes very difficult to follow their researches.

All who have interested themselves in proto-historic European ethnology are aware of the obscurity that reigns over the relationship of the early Slavonic tribes; it is only one degree better than the quite impenetrable fog surrounding the Celts. Their craniology is wholly conflicting; and to-day, if an anthropologist were to speak of "the Slavonic type," I should not have any idea whether he meant a blonde or a brunette, a long skull or a broad skull, a short or a lofty stature, narrow or wide eyes. The Slavonic languages, however, are permanent testimonies to a former linguistic unity.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.**

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

A Gynandrous Flower-Head.

A GYNANDROUS flower-head of the Iceland poppy is now in my possession. The ordinary seed-case is perfectly formed, including the stigmas. Round it are what should be the stamens; but twenty or more of these are thickened gradually upwards from



POPPY MONSTROSITY.

the base of the filament, ending in a golf-club-like head. On the outer side some of these have anthers more or less completely developed; but in all the inner side is concave, containing three to fifteen or more ovules attached round the edge. The sketch will assist in explaining this extraordinary botanical monstrosity.

J. EDMUND CLARK.

York, England.

Is There a Sense of Direction?

A RECENT article in *Science* by the facile pen of Dr. Hall on the "Sense of Direction" concedes the absence of such a faculty in civilized man at least, and possibly also in the semi-civilized as well; but he believes beyond cavil that the lower animals do have this gift denied to man.

That which appears to be a "sense of direction" in animals can, I believe, in every case be explained by the power of observation and memory, or by accident.

Men and animals alike, under given circumstances, are compelled to both observe and remember, until the one becomes as easily and unconsciously done as the other, and, for all the purposes of this article, the memory to have existence must be established upon facts learned by observation. It is very well known that an unguided horse returning to familiar haunts will do so over the same route by which he left them, rather than in a direct line by sense of direction. The very few instances recorded of animals returning from incredible distances, over which they had been carried, can doubtless be explained by their having been able to observe the route travelled, or by accident, or by the fact of their being unauthenticated nursery tales, with the possible exception of the homing pigeon, birds of wonderful flight and sight, many of which never reach home, while the arrival of many more is unaccountably delayed. Their ability to return is, I be-

lieve, no more fully explained than is the no less wonderful one of the wild water-fowls, which are taught to fly north in spring and south in autumn, or why they fly low one season and high the next, possibly in both instances determined by the character of the upper air-currents.

The case, instanced by the doctor, of the Mexican sheep-herder's ability to minutely describe travellers who had passed days previously might very aptly be used to illustrate the similarity of the mental processes necessary alike in man and animals in the matter of direction. The Mexican herder saw the travellers, to him an unusual sight, his mental perception, unoccupied by impressions other than those caused by these travellers, accurately photographed on his mind, as upon the sensitive plate of the camera, every feature of the outfit. In the case of the man, he perceived as well as saw, and could again reproduce the picture, call it up for the inspection of the mind's eye at will; but in the case of the brute that which has been seen has passed beyond possibility of recall, except by the stimulus of the same impressions repeated, when the impression is recognized as familiar. This is brute memory, possible only as a result of having seen or felt, and capable of being reproduced only by the same external agencies, and their so-called "sense of direction" is rather the faculty of recognizing at sight as familiar that which has already been seen.

If the sense of direction be inherent in animals, we would naturally inquire why it is not exhibited before they have reached mature age and been taught by experience, for it is a matter of common observation with those familiar with domestic animals that the stable-reared animal of whatever species is utterly lacking in anything bearing the faintest semblance to a sense of direction; and it is a fact within the common knowledge of most farmers' boys that cats, foragers by instinct and practice, may be carried a very few miles in a sack and never return, and that the barn-yard cock will not return from a distance of one hundred rods, although mercilessly maltreated by his new associates, for his sense of direction is determined by sight only.

All admit that many animals can and do return to their homes, but the explanation of their ability to do so need not be sought and developed by an intricate process of reasoning, if it is, as we believe, necessary that the animal first traverse the road before it can with certainty return. And in conclusion it is sufficient for me to say that, whatever instincts animals may have in this direction, man has the same, with the additional faculty of reason. In both, observation and memory can be highly cultivated, in the animal by necessity alone, and in both by experience only.

Pueblo, Colorado.

H. WORK.

Laboratory Teaching.

A RECENT number of *Science* contained a note by Professor William P. Mason referring to a statement of mine concerning the early years of laboratory teaching in chemistry. I need not state that I had no intention of withholding credit from any of the pioneers in the development of scientific education, especially from such institutions as the Rensselaer Polytechnic Institute, which, as everyone knows, from the first has been in the foremost rank. I had in mind the course of laboratory instruction in general chemistry which was established for the training of large classes at the Massachusetts Institute of Technology by Professors Eliot and Storer. This method of instruction, adapted to later advances in knowledge and to the needs of individual laboratories, is now in very general use in teaching elementary chemistry.

CHARLES F. MABERY.

Animal Phosphorescence.

ALL sorts of theories have been advanced to explain generally the real use of these luminous emanations. Some have supposed that the light is intended as an effective aid to the night birds that feed upon this gorgeous fare. But that would certainly be a left-handed provision of nature, quite out of her usually kindly protection. Others, again, guess that the firefly's flash-light is a device to assist him in the search of his own prey. With none of these theories, however, is science fully satisfied, and in the

judgment of the most prudent naturalists the real use of the luminosity of these insects is still utterly unknown.

Can any of the readers of *Science* give me "a great light" on the subject in dispute?

CHARLES NIEDLINGER.

New York, 5 East 16th St., Sept. 26.

BOOK-REVIEWS.

An Account of the Principal Facts and Theories Relating to the Colors and Markings of Animals. By FRANK E. BEDDARD, M.A. New York, Macmillan & Co. 8°. \$3.50.

THERE is significance in the number of recent works involving a discussion of questions of biological philosophy and a presentation of fundamental principles to intelligent non-scientific thinkers. Starting with Darwin's "Origin of Species," a steadily increasing volume of this kind of literature has been produced to supply an intellectual demand, in itself a grateful proof of the re-adjustment and betterment of the relations between scientists and other thinkers.

Among these newly developed lines of thought, none is more interesting than the significance of coloration in the organic world; and none deals with a subject more intrinsically beautiful. The work under review is an attractive book on an attractive subject. The press-work is good, the type clean and sufficiently large. The four colored plates are a feature which will be much appreciated, while the wood-cuts are well selected and well executed, with the exception of the illustration of the sloth, which is little short of execrable.

The classification of colors according to their supposed purpose is much less intricate than that adopted by Poulton, and not very unlike that of Wallace. A compromise between Poulton and Beddard would have its advantages. Contrary to the promise of the author in the introductory chapter, he has used insects almost, if not quite, as much as Poulton in the presentation of his subject. The author says that his book "contains nothing novel," but we

think that he is over modest in this, for his excellent series of experiments for the purpose of determining the palatability of various animals is both new and very much to the point.

In the introductory chapter the origin of animal coloration is explained, and an indication of the anti-Darwinian trend of the work is furnished by a denial of the fact that coloration is always in harmony with the mode of life of the animal, a question which might still be left *sub judice*. Albinism is considered an individual variation, although there is much to indicate that it is a physiological weakness or dermal disease. Although Mr. Beddard does not touch upon the transmission of acquired characters, perhaps thereby showing his wisdom, he is evidently intensely Lamarckian in his beliefs. A comparison between Wallace's "Darwinism" and Beddard's "Coloration of Animals" would be instructive perhaps, but sorely perplexing to the general student, who cares more for ascertaining the truth than being *au fait* in theories. Natural selection is apotheosized by the former, while no author is more persistent in his attempts to minimize the effects of natural selection than the latter. Here again middle ground would seem more safe.

Our author concludes that "the brilliant and varied coloration of deep-sea animals is totally devoid of meaning," a conclusion that will doubtless meet with considerable opposition.

Chapter II., on coloration as affected by environment, is a thoroughly Lamarckian chapter with many significant facts. The nature and quantity of food is held to materially affect coloration. Moisture deepens colors, while a dry climate lightens them. The white of Arctic animals, it is maintained, is due to environment, although this proposition can hardly be said to be substantiated in a satisfactory manner.

In Chapter III., on protective coloration, this well-worn but never tiresome subject is illustrated by a large number of examples in much the usual way. The author is surprised at the small number of green animals frequenting trees. We are inclined to think the number much greater than he admits. For instance, a

Publications Received at Editor's Office.

- BAILEY, L. H. *The Horticulturist's Rule-Book.* New York, Rural Pub. Co. 12°. 221 p.
JOHNSON, WILLIAM W. *The Theory of Errors and Method of Least Squares.* New York, John Wiley & Sons. 12°. 162 p. \$1.50.
MACCORD, CHARLES W. *Mechanical Drawing.* New York, John Wiley & Sons. 4°. 100 p. \$4.
MERRIMAN, MANSFIELD. *A Text-Book on the Method of Least Squares.* 6th ed. New York, John Wiley & Sons. 8°. 206 p. \$2.
MERRIMAN, MANSFIELD. *An Introduction to Geodetic Surveying. Part I. The Figure of the Earth.* New York, John Wiley & Sons. 8°. 170 p. \$2.
MILNE, WILLIAM J. *Standard Arithmetic.* New York, American Book Co. 12°. 423 p. 65 cts.
POOR, HENRY V. *The Tariff.* New York, H. V. & H. W. Poor. 8°. Paper 121 p.

Reading Matter Notices.

- Ripans Tabules cure hives.
Ripans Tabules cure dyspepsia.

FOR SALE.

The Paleontological Collection of the late U. P. James, of Cincinnati, Ohio. Many type specimens and thousands of duplicates. For further information address

JOSEPH F. JAMES,

U. S. Department of Agriculture,
WASHINGTON, D. C.

RESTORE YOUR EYESIGHT

Cataracts, scars or films can be absorbed and paralyzed nerves restored, **without the knife or risk.** Diseased eyes or lids can be cured by our home treatment. "We prove it." **Hundreds convinced.** Our illustrated pamphlet, "Home Treatment for Eyes," free. Don't miss it. **Everybody wants it.** "THE EYE," Glens Falls, N.Y.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For Sale or Exchange.—The subscriber would like to receive cash offers, or an offer in exchange for the earlier volumes of Poggendorf's *Annalen* and the later volumes of Silliman's *Journal*, upon the following list: (Chenn—Manuel de Conchyliologie. 2 vols. Nearly 5,000 figures, some hand-colored. Paper. Paris, 1859. Edwards.—Butterflies of N. A. 2 vols. Plates hand-colored. Vol. I., half calf. Vol. II. in parts. Leyman, Agassiz, Hagen.—Ills. Cat. Mus. Comp. Zoöl. at Harvard. No. I. Ophiuridae. No. II., Acalephae. No. III., Astacidae. All bound in one volume. American Naturalist. Vols. I.-VII. Cloth. Silliman's Am. Jour. of Science and Arts. Third Series. Vols. I.-X. Cloth. Binney.—Terrestrial Mollusks of N. A. Colored plates. 4 vols. Stretch.—Zygaenidae and Bombycidae of N. A. Colored plates. Also a considerable library of monographs, reports, and scientific books, and a large number of duplicates of fossils, minerals and shells. E. A. STRONG, Ypsilanti, Mich., Sept., 1892.

Exchange.—I have the finest shells of *Anodonta corpulenta*, C'pr, and *Suborbiculata*, Say, in the world. Will exchange for fresh water, land, and marine shells, in large or small quantities. Have also for exchange 50 varieties of fresh water and land shells from Spoon River, Ill. Dr. W. S. STRODE, Lewistown, Ill.

To exchange for books on birds or insects, or for back volumes of *American Naturalist*: Ecker's "Anatomy of the Frog," Packard's "Guide," Guyot's "The Earth and Man," Reckhills, "The Land of the Lamas," Parker's "Biology," Shoemaker's "Hereditry, Health and Personal Beauty," Dexter's "The Kingdoms of Nature," all new. M. J. ELROD, Ill. Wes. Univ., Bloomington, Ill.

For Sale.—About 1087 volumes of the private library of Dr. Nicolas León, formerly director of the Museum at Morelia, embracing publications of special value for Mexicoologists, like those of Bishop Zumárraga (16th century), of Sigüenza y Gongora, of Aleman, etc., the *Missal* of Spinoza, a very scarce manuscript on the history of Michoacán and other Mexican States, on the Tarasco (the Indian language of Michoacán) and several works, of which the only copy known to exist is in this collection. Parties interested in the sale please address Dr. NIC. LEÓN, Portal de Matamoros, Morelia, Mexico.

Wants.

METALLURGICAL CHEMIST will give instruction in the metallurgy and chemical analysis of iron and steel. Complete or special courses applying to the manufacture of pig irons and steels, as well as to their uses. Address "METALLURGIST," care SCIENCE.

A GRADUATE of the University of Pennsylvania, and a practical mineralogist of twenty years' experience desires to give his services and a cabinet of 25,000 specimens, all named, with about the same number of duplicates, in minerals, crystals, rocks, gems, fossils, shells, archaeological and ethnological specimens and woods to any institution desiring a fine outfit for study. The owner will increase the cabinet to 50,000 specimens in two years, and will act as curator. Correspondence solicited from any scientific institution. J. W. HORTER, M.D., Ph.D., San Francisco, Cal., General P. O. Delivery.

WANTED.—A position as zoological artist in connection with a scientific expedition, institution or individual investigations. Experienced in microscopic and all scientific work. References given if desired. Address J. HENRY BLAKE, 7 Prentiss Place, N. Cambridge, Mass.

CHEMIST AND ENGINEER, graduate German Polytechnic, Organic and Analytical, desires a position in laboratory or chemical works. Address 213½ E. 7th Street, New York, care Levy.

A MAN, 36 years old, of extensive experience, having the degrees of A.M. and Ph.D., desires a first-class opening as a teacher of Zoology and kindred studies in a college or university. Can furnish numerous testimonials or references as to success and skill in most modern laboratory methods. Address E. W. D., Md. Agr. College, College Park, Md.

A JOHNS HOPKINS graduate (1892) desires a position as instructor in mathematics and physics. Address A. B. TURNER, Johns Hopkins University, Baltimore, Md.

A YOUNG MAN, with a thorough training in Analytical Chemistry (including analysis of minerals, food, water, etc.), and holding a diploma of the School of Practical Science, of Toronto, and good testimonials, desires a position as Analytical Chemist or as assistant to such. Address to WM. LAWSON, 16 Washington Ave., Toronto, Ontario.

vast multitude of birds are green or olivaceous, at least dorsally. On the other hand, tree-frequenting animals, perhaps a majority of them, are better protected by a color-resemblance to bark than to leaves, and they are certainly so protected. The author combats here, as elsewhere, the exclusive or even general agency of natural selection. He confesses that "at every step, in fact, in the study of animal coloration we are met with closed doors, which can only be unlocked by keys furnished by an intimate chemical and physiological knowledge, such as we do not at present possess."

In Chapter IV., on warning coloration, we find the most valuable original feature of the work—the numerous experiments with the palatability of animals, especially insects generally supposed to illustrate warning coloration. These experiments, although furnishing somewhat contradictory evidence, are in the main a valuable confirmation of previous ideas. Dr. Eisig's theory of warning colors is advocated. He thinks that "the brilliant colors have caused the inedibility of the species, rather than that the inedibility has necessitated the production of bright colors as an advertisement," a somewhat startling if not revolutionary idea.

Chapter V. is on protective mimicry. This ever-delightful theme is well handled, although we can hardly repress an instinctive shudder at the iconoclasm which seeks to tear down the exquisite structure so beautifully wrought by Bates, Wallace, Belt, and others, and we hope to be forgiven for expressing a perhaps unscientific but deep-seated aversion to this attempted destructive criticism of the conclusions of those whose knowledge was gained in the woods and fields rather than in the laboratory or dissecting-room.

Chapter VI. treats of sexual selection; but lack of space forbids more than a mention of this chapter, except to enter a protest against the idea that birds do not possess an exalted æsthetic sense. Here again the field-naturalist will be apt to agree with Poulton, who, after presenting a large array of facts, says: "Such facts

point toward the existence of a widespread æsthetic sense in the higher animals."

The book as a whole is a valuable contribution to the literature of an intensely interesting subject, and will doubtless be read with pleasure and profit by thousands who do not claim to be scientists.

C. C. NUTTING.

State University, Iowa City, Iowa.

Handbook of School Gymnastics of the Swedish System. By BARON NILS POSSE. Boston, Lee & Shepard.

THE merit of the Swedish system consists in the effort to develop in a scientific and systematic manner all the parts of the body. It is not an attempt to make a derrick of the human body by the excessive development of a few lifting muscles, nor does it aim at drills which make an attractive show by the simultaneous movements of identical parts of the body. It discards the old rhythmical and automatic movements as being of but little value. The fundamental principles and advice which form the introductory portion of this little handbook give this definition: "The aim of educational gymnastics is to develop the body into a harmonious whole under the perfect control of the will. It is not to produce great bulk of muscle, but to cause that already present to respond readily to volition, to improve the functional activity of the body, and to counteract and correct tendencies to abnormal development, especially those resulting from 'the artificial life of civilization.' . . . Movements are chosen for physical and physiological effects, local or general, so that only those exercises are used whose effects are needed, and those are excluded whose effects are doubtful or pernicious."

Attention in this country was first called to the Swedish gymnastics by the introduction of the Swedish movement-cure. Though we derive this massage treatment from Sweden, the Japanese have practised a similar method for centuries, utilizing blind people as masseurs.

This handbook will be of great assistance to those who have studied the system.

Dyspepsia

Dr. T. H. Andrews, Jefferson Medical College, Philadelphia, says of Horsford's Acid Phosphate.

"A wonderful remedy which gave me most gratifying results in the worst forms of dyspepsia."

It reaches various forms of Dyspepsia that no other medicine seems to touch, assisting the weakened stomach, and making the process of digestion natural and easy.

Descriptive pamphlet free on application to Rumford Chemical Works, Providence, R. I.

Beware of Substitutes and Imitations.

For sale by all Druggists.

LITERARY OUTFIT FREE.

Any one sending us \$1.00 at once and mentioning "Science," will receive a copy of "Historical Sketches and Events in the Colonization of America," by G. B. Hall. A square 8vo. book (6½x9 inches), 223 pages, illustrated. This is a regular \$2.00 book and a bargain at that price. . . . \$ 2 00

200 Private Library Labels; they should be used by all who own books. . . . 50
"The Library," a 100-page book containing a brief list of most important standard and miscellaneous books in every department of literature. Intended for those who are about forming a library. Hints about what books to read and how to buy them. . . . 50

1 year's subscription to the "Literary Light," a monthly magazine of Ancient, Medieval and Modern Literature. . . . 1 00

\$4.00 actual value for \$1.00. Sample copy of "Literary Light," 10 cents (postal card won't do).

Address, **Literary Light,**
243 4th Ave. S. Minneapolis, Minn.

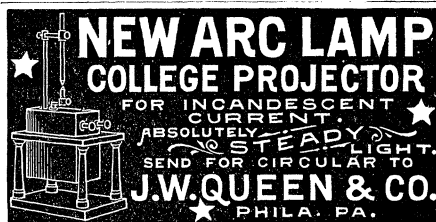
ADDRESS ON THE DEVELOPMENT OF THE

MEMORY

To introduce a series of valuable educational works the above will be sent to all applicants

FREE

Room **JAMES P. DOWNS, PUBLISHER,**
327. 243 BROADWAY, NEW YORK.



NEW ARC LAMP
COLLEGE PROJECTOR
FOR INCANDESCENT CURRENT.
ABSOLUTELY STEADY LIGHT.
SEND FOR CIRCULAR TO
J.W. QUEEN & CO.
PHILA. PA.

MINERALS. Cabinet Specimens, Collections, and material by the pound, for mineralogists, collectors, colleges, schools, and chemists. Send for 100-page catalogue, paper bound, 15 cents; cloth bound, 25 cents; supplement, 2 cents. Geo. L. English & Co., Mineralogists, 733 & 735 B'way, N. Y.

THE LABRADOR COAST.

A JOURNAL OF TWO SUMMER CRUISES TO THAT REGION.

WITH NOTES ON ITS EARLY DISCOVERY, ON THE ESKIMO, ON ITS PHYSICAL GEOGRAPHY, GEOLOGY AND NATURAL HISTORY, TOGETHER WITH A BIBLIOGRAPHY OF WORKS, ARTICLES, AND CHARTS RELATING TO THE CIVIL AND NATURAL HISTORY OF THE LABRADOR PENINSULA.

By ALPHEUS SPRING PACKARD, M.D., Ph.D.

Sportsmen and ornithologists will be interested in the list of Labrador birds by Mr. L. W. Turner, which has been kindly revised and brought down to date by Dr. J. A. Allen. Dr. S. H. Scudder has contributed the list of butterflies, and Prof. John Macoun, of Ottawa, Canada, has prepared the list of Labrador plants.

Much pains has been taken to render the bibliography complete, and the author is indebted to Dr. Franz Boas and others for several titles and important suggestions; and it is hoped that this feature of the book will recommend it to collectors of *Americana*.

It is hoped that the volume will serve as a guide to the Labrador coast for the use of travellers, yachtsmen, sportsmen, artists, and naturalists, as well as those interested in geographical and historical studies.

513 pp., 8°, \$3.50.

N. D. C. HODGES,

874 BROADWAY, NEW YORK.

FIRST STEPS IN PHILOSOPHY.

(Physical and Ethical.)

By William Mackintire Salter,
Author of "Ethical Religion."

This little book aims to answer in a thorough-going and scientific way two fundamental inquiries, What is Matter? and What is Duty? Clear notions on these points constitute, in the author's judgment, indispensable preliminary steps to any sound thinking in philosophy. What degree of success he attains his readers and critics must judge. He avoids technical language and puts his thoughts in simple and popular form. The book is not so much for philosophers as for ordinary men and women who are feeling their way to an intelligible and satisfactory view of the world.

Cloth, 16mo, 156 pages, \$1.00, postpaid.

Our Heredity from God. Lectures on Evolution. By E. P. Powell. Cloth, 12mo, 416 pages, \$1.75.

It comes nearer being the hand-book of evolution, adapted to those who not only are looking for a clear summary of the evidences of evolution in the physical world, but are anxious to know its bearings upon morals and religion, than any book we know of.—*Unity, Chicago.*

Altogether the book is the most cogent, candid, and absorbingly interesting of the many discussions of this momentous doctrine, by a thinker who both sees and states clearly its tremendous import.—*Chicago Times.*

Liberty and Life. Seventeen discourses on the applications of scientific truth to morals and religion. By E. P. Powell. 12mo, 208 pages, cloth, \$1.00; paper, 60 cents.

Strong, even, bold essays on ethical and religious subjects. They are the work of a man of vigorous intellect, who has studied the doctrine of evolution long and carefully, and has not found it necessary to abandon all his old reverences. The discourses are full of interest to the casual reader by reason of their fund of anecdote and biographical citation, and to the seeker for religious and moral truth they offer many helps.—*Literary World.*

The Evolution of Immortality. Suggestions of an individual immortality based upon our organic and life history. By E. T. Stockwell. Third edition, with appendix. Cloth, 12mo, 104 pages, 60 cents.

A thoughtful little book, which considers the growth of human being from embryological and cell-life up to the origin and evolution of consciousness, and noting at every step the anticipation of the next, is justified in looking forward in the same line from the present point. It is worth reading.—*Atlantic Monthly.*

Religion and Science as Allies, or Similarities of Scientific and Religious Knowledge. By James Thompson Bixby, Ph.D. Paper, 12mo, 226 pages, 30 cents; cloth, 50 cents.

The best book published on the relations of science and religion.—*Christian Union.*

We have felt much gratification in the perusal of Mr. Bixby's argument. It is written in a highly commendable spirit and with a good general knowledge and appreciation of philosophic data, and its rich suggestions will be found to be by no means one of its least important merits.—*New York Times.*

The Unending Genesis; or, Creation Ever Present. By Henry M. Simmons. Paper, square 18mo, 111 pages, 25 cents.

Here the story of the creation is told in a reverential, loving spirit, showing clearly how evolution has been going on for hundreds of centuries and must still go on, and proving also how one overruling power works through all, with a perfect and beautiful mathematical precision.—*Unity.*

Evolution and Christianity. A Study. By J. C. F. Grumbine. Cloth, square 18mo, 75 pages, 30 cents.

Mr. Grumbine's statements are sound and well put. His book is the fruit of wide reading and investigation. It is a helpful one, is thoroughly interesting reading, and its presentation of the relation between evolution and Christianity includes much valuable thought.—*Buffalo Express.*

The God of Science. By Francis Ellingwood Abbot. Paper, 8vo, 16 pages, 10 cents.

Evolution in its Relations to Evangelical Religion. By B. F. Underwood. Paper, 24mo, 21 pages, 5 cents.

Any of the books named above will be mailed on receipt of price. Write for full catalogue. Address

CHARLES H. KERR & CO., Publishers,
175 Dearborn St., Chicago.

JOHN IRELAND'S Bookstore, 1197 Broadway

near 23rd St., is convenient to the residence quarter of the city; it is a good place to drop into on the way up or down town to select books or stationery. His stock is well selected and embraces all the new and standard books as soon as issued. Out-of-town purchasers can order by mail with every confidence that their wants will be as well supplied as if buying in person.

AUTHORS AND PUBLISHERS.

Material arranged and compiled for all kinds of works, excepting fiction. Statistics a specialty. Indexing and cataloguing. Address G. E. BIVER, 835 N. 16th Street, Philadelphia.

BACK NUMBERS and complete sets of leading Magazines. Rates low. AM. MAG. EXCHANGE, Scholastic N.Y.

TO THOSE INTERESTED IN SCIENCE.

[Science (weekly) established in 1883, N. D. C. HODGES,
874 Broadway, New York City.]

Titles of Some Articles Published in *Science* since

Jan. 1, 1892.

Aboriginal North American Tea.
Actinism.
Agriculture, Experimental, Status of.
Amenhotep, King, the tomb of.
Anatomy, The Teaching of, to Advanced Medical Students.
Anthropology, Current Notes on.
Architectural Exhibition in Brooklyn.
Arsenical Poisoning from Domestic Fabrics.
Artesian Wells in Iowa.
Astronomical Notes.
Bacteria, Some Uses of.
Bird on Its Nest, The.
Birds Breeding at Hanover, N. H.
Botanical Laboratory, A.
Botanists, American and Nomenclature.
Brain, A Few Characteristics of the Avian.
Bythoscopidae and Cereopidae.
Canada, Royal Society of.
Celts, The Question of the.
Chalicotherium, The Ancestry of.
Chemical Laboratory of the Case School.
Children, Growth of.
Collection of Objects Used in Worship.
Cornell, The Change at.
Deaf, Higher Education of the.
Diamonds in Meteorites.
Diphtheria, Tox-Albumin.
Dynamics, Fundamental Hypotheses of.
Electrical Engineer, The Technical Education of.
Eskimo Throwing Sticks.
Etymology of two Iroquoian Compound Stems.
Eye-Habits.
Eyes, Relations of the Motor Muscles of, to Certain Facial Expressions.
Family Traits, Persistency of.
Fishes, The Distribution of.
Fossils, Notice of New Gigantic.
Four-fold Space, Possibility of a Realization of.
Gems, Artificial, Detection of.
Glacial Phenomena in Northeastern New York.
Grasses, Homoptera Injurious to.
Great Lakes, Origin of the Basins of.
"Healing, Divine."
Hemipter, us Mouth, Structure of the.
Hofmann, August Wilhelm von.
Hypnotism among the Lower Animals.
Hypnotism, Traumatic.
Indian occupation of New York.
Infant's Movements.
Influenza, Latest Details Concerning the Germs of.
Insects in Popular Dread in New Mexico.
Inventions in Foreign Countries, How to Protect.
Inventors and Manufacturers Association.
Iowa Academy of Sciences.
Jargon, The Chiuook.
Jassidæ, Notes on Local.
Keller, Helen.
Klamath Nation, Linguistics.
Laboratory Training, Aims of.
Lewis H. Cavill, Work on the Glacial Phenomena.
Lighting, New Method of Protecting Buildings from.
Lion Breeding.
Lissajous's Curves, Apparatus for the Production of.
Maize Plant, Growth and Chemical Composition of.
Maya Codes, a Key to the Mystery of.
Medicine, Preparation for the Study of.
Mineral Discoveries, Washington.
Museums, The Support of.
Palaenque Tablet, a Brief Study of.
Patent Office Building, The.
Physa Heterostrophæ Lay, Notes on the Fertility of.
Pict's House, A.
Pocket Gopher, Attempted Extermination of.
Polariscopes, Direct Reflecting.
Psychological Laboratory at Toronto.
Psychological Training, The Need of.
Paylla, the Pear-Tree.
Rain-Making.
Rice-Culture in Japan, Mexico and the United States.
Rivers, Evolution of the Loup, in Nebraska.
Scientific Alliance, The.
Sistrurus and Crotalophorus.
Star Photography, Notes on.
Star, The New, in Auriga.
Storage of Storm-Waters on the Great Plains.
Teaching of Science.
Tiger, A New Sabre-Toothed, from Kansas.
Timber Trees of West Virginia.
Tracheæ of Insects, Structure of.
Vein-Formation, Valuable Experiments in.
Weeds as Fertilizing Material.
Weeds, American.
Will, a Recent Analysis of.
Wind-Storms and Trees.
Wines, The Sophisticated French.
Zoology in the Public Schools of Washington, D. C.

Some of the Contributors to *Science* Since Jan. 1, 1892.

Aaron, Eugene M., Philadelphia, Pa.
Allen, Harrison, Philadelphia, Pa.
Ashmead, Albert S., New York City.
Bailey, L. H., Cornell University, Ithaca, N. Y.
Baldwin, J. Mark, University of Toronto, Canada.

Ball, V., C. B., LL.D., F.R.S., Dublin, Ireland.
Barnes, Charles Reid, Madison, Wis.
Baur, G., Clark University, Worcester, Mass.
Beal, W. J., Agricultural College, Mich.
Beals, A. H., Milledgeville, Ga.
Beauchamp, W. M., Baldwinsville, N.Y.
Bell, Alexander Graham, Washington, D. C.
Boas, Franz, Clark University, Worcester, Mass.
Bolley, H. L., Fargo, N. Dak.
Bolles, Frank, Cambridge, Mass.
Bostwick, Arthur E., Montclair, N.J.
Bradley, Milton, Springfield, Mass.
Brinton, D. G., Philadelphia, Pa.
Call, E. Ellsworth, Des Moines, Ia.
Chandler, H., Buffalo, N.Y.
Comstock, Theo. B., Tucson, Arizona.
Conn, H. W., Middletown, Conn.
Coulter, John M., Indiana University.
Cragin, F. W., Colorado Springs, Col.
Cresson, Hilborne T., Philadelphia, Pa.
Davis, W. M., Harvard College, Cambridge, Mass.
Dimmock, George, Canobie Lake, N.H.
Dixon, Edward T., Cambridge, England.
Farrington, E. H., Agric. Station, Champaign, Ill.
Ferreë, Barr, New York City.
Fessenden, Reginald A., Lafayette, Ind.
Flexner, Simon, Johns Hopkins, Baltimore, Md.
Foshay, P. Max, Rochester, N.Y.
Gallaudet, E. M., Kendall Green, Washington, D.C.
Garman, S., Mus. Comp. Zool., Cambridge, Mass.
Gibbs, Morris, Kalamazoo, Mich.
Golden, Katherine E., Agric. College, Lafayette, Ind.
Grinnell, George B., New York City.
Hale, Edwin M., Chicago, Ill.
Hale, George S., Boston, Mass.
Hale, Horatio, Clinton, Ontario, Canada.
Hall, T. Proctor, Clark University, Worcester, Mass.
Halsted, Byron D., Rutg. Coll., New Brunswick, N.J.
Haworth, Erasmus, Oskaloosa, Iowa.
Hay, O. P., Irvington, Ind.
Haynes, Henry W., Boston, Mass.
Hazen, H. A., Weather Bureau, Washington, D.C.
Hewitt, J. N. B., Bureau of Ethnol., Washington, D. C.
Hicks, L. E., Lincoln, Neb.
Hill, E. J., Chicago, Ill.
Hill, Geo. A., Naval Observatory, Washington, D.C.
Hitchcock, Romyn, Washington, D.C.
Holmes, E. L., Chicago, Ill.
Hoskins, L. M., Madison, Wis.
Hotchkiss, Jed., Staunton, Va.
Houston, Edwin J., Philadelphia, Pa.
Howe, Jas. Lewis, Louisville, Ky.
Hubbard, Gardiner G., Washington, D.C.
Jackson, Dugald C., Madison, Wisconsin.
James, Joseph F., Agric. Dept., Washington, D.C.
Johnson, Roger B., Miami University, Oxford, O.
Keane, A. H., London, England.
Kellerman, Mrs. W. A., Columbus, O.
Kellicott, D. S., State University, Columbus, O.
Kellogg, D. S., Plattsburgh, N. Y.
Lintner, J. A., Albany, N. Y.
Loeb, Morris, New York City.
Mabery, Charles F., Cleveland, Ohio.
Macloskie, G., Princeton, N.J.
McCarthy, Gerald, Agric. Station, Raleigh, N. C.
MacDonald, Arthur, Washington, D.C.
MacGregor, J. C., Halifax, Nova Scotia.
MacRitchie, David, Easter Logie, Perthshire, Scotland.
Marshall, D. T., Metuchen, N.J.
Mason, O. T., Smithsonian Inst., Washington, D. C.
Mill-paugh, Charles F., Morgantown, W. Va.
Morse, Edward S., Salem, Mass.
Nichols, C. F., Boston, Mass.
Nuttall, George H. F., Johns Hopkins, Baltimore Md.
Oliver, J. E., Cornell University, Ithaca, N.Y.
Osborn, Henry F., Columbia College, New York City.
Osborn, Herbert, Agricultural College, Ames, Iowa.
Pammel, L. H., Agricultural Station, Ames, Iowa.
Pillsbury, J. H., Smith College, Northampton, Mass.
Poteat, W. L., Wake Forest, N. C.
Preble, Jr., W. P., New York City.
Prescott, Albert B., Ann Arbor, Mich.
Riley, C. V., Washington, D. C.
Ruffner, W. H., Lexington, Va.
Sanford, Edmund C., Clark Univ., Worcester, Mass.
Scripture, E. W., Clark University, Worcester, Mass.
Seler, Dr. Ed., Berlin, Germany.
Shufeldt, R. W., Washington, D. C.
Slade, D. D., Museum Comp. Zool., Cambridge, Mass.
Smith, John B., Rutgers Coll., New Brunswick, N. J.
Southwick, Edmund B., New York City.
Stevens, George T., New York City.
Stevenson, S. Y., Philadelphia, Pa.
Stone, G. H., Colorado Springs, Col.
Taylor, Isaac, Settrington, England.
Thomas, Cyrus, Washington, D. C.
Thurston, R. H., Cornell University, Ithaca, N.Y.
Todd, J. E., Tabor, Iowa.
True, Frederick W., Nat. Mus., Washington, D.C.
Turner, C. H., Univ. of Cincinnati, Cincinnati, O.
Wake, C., Stanland, Chicago, Ill.
Ward, R. DeC., Harvard Univ., Cambridge, Mass.
Ward, Stanley M., Scranton, Pa.
Warder, Robert B., Howard Univ., Washington, D.C.
Welch, Wm. H., Johns Hopkins, Baltimore, Md.
West, Gerald M., Clark University, Worcester, Mass.
Whitman, C. O., Clark University, Worcester, Mass.
Williams, Edward H., Lehigh Univ., Bethlehem, Pa.